



ANALYSIS

China's Reforestation Programs: Big Success or Just an Illusion?

China has undertaken ambitious reforestation initiatives that have increased its forest cover dramatically in the last decade. But scientists are now raising questions about just how effective these grand projects will turn out to be.

BY JON R. LUOMA

In China, major environmental degradation caused by deforestation was apparent even 2,000 years ago, when the great waterway once simply called “The River” was visibly transformed. Tree-felling all along the river’s banks wiped out root systems that held erosion in check, allowing tons of sediments to spread their stains into what has been known ever since as the Yellow River.

In the years after World War II, with its population booming and a massive drive to industrialize in full swing, China became an epicenter of world deforestation, clearing land wholesale for purposes that ranged from growing more food to fueling furnaces for smelting steel. More recently, however, the nation appeared to be reversing that trend, largely with massive campaigns to plant trees. In the first decade of the new millennium, China annually increased its forest cover by 11,500 square miles, an area the size of Massachusetts, according to a 2011 report from the United Nations.

But scientists and conservation groups are beginning to voice concerns about the long-term viability of significant aspects of China’s reforestation push. Of greatest concern is the planting of large swaths of non-native tree species, many of which

China’s ‘Great Green Wall’ was designed to plant nearly 90 million acres of new forest.

perish because their water needs are too great for the arid regions in which they are planted. China also is cultivating large monoculture plantations that harbor little biodiversity.

Some international conservation groups, working with Chinese partners, have launched small-scale reforestation and grassland projects using native species, but it remains to be seen whether these ventures can help usher in a new era of more ecologically sound reforestation in China.

One project being closely scrutinized by Chinese and foreign scientists is a vast, multi-decade scheme aimed at abating desertification — the largest of several regional efforts to increase forest cover in China. Initiated in 1978 and slated to continue until 2050, the Three Norths Shelterbelt Development Program — informally called the “Great Green Wall” — was designed to eventually plant nearly 90 million acres of new forest in a band stretching 2,800 miles across northern China.

That could make it the largest ecological restoration project ever accomplished. But some scientists who have examined long-term trends suggest this large-scale tree-planting campaign is far less than the miracle it appears to be. Indeed, Jiang Gaoming, an ecologist at the Chinese Academy of Sciences, has characterized it as more of a “fairy tale.”

To be sure, trees have been planted, with millions of seeds dropped from airplanes and millions more small seedlings manually planted. But in an extensive analysis of such “afforestation” efforts published last year in *Earth Science Reviews*, Beijing Forestry University scientist Shixiong Cao and five co-authors say that on-the-ground surveys have shown that, over time, as many as 85 percent of the plantings fail.

The Great Green Wall program was designed to reverse decades of desertification. As deserts expanded in China, they helped feed enormous dust storms — “yellow dragons” — that still routinely clog the air in Beijing and as far away as Korea. The Great Green Wall was aimed at quickly turning back the spread of desert by planting fast-growing trees, such as aspen, that would rapidly establish deep webs of soil-stabilizing roots and form a shady canopy. The new forest could also potentially provide some local economic benefits in the form of wood fiber for paper pulp or building materials.

The study's co-author notes that the trees planted 'are not native to the region and don't tolerate local conditions.'

Even though they were being planted in a semi-arid region where historically grassy steppe prevailed, the trees appeared to be a suitable choice, since they were able to tap water stored deep in soils.

Nevertheless, says David Shankman — a geographer at the University of Alabama and a co-author of the study — over years or decades the plantings have tended to eventually deplete local soil moisture and die en masse simply because the planted species “are not native to the region, and don't tolerate local conditions.”

Because it has evolved locally, native vegetation tends to function in equilibrium with the resources available to it, including water. And in early years, the newly planted tree species appeared not to suffer because they were effective at pushing their roots ever-deeper in search of stored soil moisture.

But as the authors explain, “This, however, only delays the inevitable: drying of the surface soils is followed by the depletion of deep soil water, leading to lowering of the water table and high rates of tree mortality when tree roots can no longer reach deep soil water.”

Recent research suggests the reforestation effort has done little to abate China's great yellow dust storms.

In other words, along comes a final dry cycle, and thirsty trees that had been appearing to thrive suddenly perish.

The report in *Earth Science Reviews* suggests that ecological problems begin even before the thirsty trees themselves die off. When the trees are still growing, they take up water that otherwise would have been unavailable for shallower-rooting native shrubs and grasses. Meanwhile, their limbs and leaves tend to form a tight canopy so shady that it also hampers photosynthesis by smaller plants on the forest floor. As these plants die off, soil on the surface of the forest floor is exposed to wind erosion, the very problem the trees were planted to prevent.

“Attempts to control desertification and soil erosion by afforestation have had little success,” Cao and his fellow researchers conclude, pointing out that recent research suggests that the giant effort has done little even to abate China's great yellow dust storms.

Writing in *Nature* in September, Jianchu Xu, senior scientist at the World Agroforestry Centre and a professor at the Kunming Institute of Botany, Chinese Academy of Science, echoed concerns about the dangers of planting maladapted tree species in China's arid environments, noting that native perennial grasses, “with their extensive root systems would be better protectors of topsoil.”

He also pointed out that plantation forests tend to be driven by commercial considerations. Monoculture plantations that succeed can eventually offer economic benefits in the form of saw timber, fiber for the pulp and paper industry, rubber, and even food in the form of fruit. But, noted Xu, “Plantation monocultures harbor little diversity; they provide almost no

Chinese ecologist Jiang Gaoming has called for 'nurturing the land by the land itself.'

provide windbreaks, and tree plantations offer some carbon storage. But these benefits come at a high cost to other ecological functions.”

What *could* work? Going native. Beyond protecting what native ecosystems remain, some research suggests that simply preventing further abuse of degraded ecosystems can allow them to recover.

Chinese ecologist Jiang Gaoming has called for “nurturing the land by the land itself.” In a region of Inner Mongolia called the “Hunshandake sandy land,” his team of researchers has shown that native grasslands will restore themselves in as little as two years if fencing can be installed to eliminate livestock grazing and other human incursions.

One project underway in a region of Southwest China, under a partnership between Conservation International and China's Center for Nature and Society, could serve as a better model. In a 100,000-square-mile region that includes ecosystems ranging from coniferous and broadleaf forests, to grasslands, wetlands and bamboo groves, the project has already restored more than 12,000 acres using native species.

In what could be a hopeful turn, China's State Forestry Administration has indicated that it has gotten the message. The nation's lead forestry agency has begun collaborating on projects aimed specifically at restoring native species. The agency is working with the Climate Community and Biodiversity Alliance (CCBA), whose members include Conservation International, the Nature Conservancy, and the Rainforest Alliance.

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One of the first of the proposed projects would reforest more than 10,000 acres of severely degraded former forest lands in five counties in Sichuan province, a mountainous region surrounding the upper reaches of the Yangtze and Daduhe Rivers. The area in general is classified by Chinese environmental agencies as a “biological hotspot” that includes — where it's still intact — habitat for the giant panda.

Following new standards developed by CCBA, the project will primarily use native species, including Armand pine, China cedar, and local varieties of fir, spruce, poplar, and alder. In addition to sequestering a projected 41,000 tons of greenhouse gases annually, the project is projected to create one million person-hours of work in tree planting, thinning, and — once the forest matures — selective local lumber harvesting.

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